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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/826,842	MUKERJEE, KUNAL	
	Examiner	**Art Unit**	
	Mia M. Thomas	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 5-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 5-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 July 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/07/08*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to Applicant's remarks received on 07 July 2008. Claims 1-21 are pending in the application. Claims 1-21 are rejected. Claims 1, 10, 14, 18 and 20 are independent. Claims 1, 6, 10, 12, 14, 15, 17, 18 and 20 are amended. Claims 3 and 4 are canceled.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 9, 10, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merhav et al. "Optimal Prefix Codes for Sources with Two-Sided Geometric Distributions", IEEE Transactions on Information Theory, Vol. 46, No. 1, January 2000, pages 121-135, hereinafter referred to as Merhav, in combination with Sudharsanan et al. (US 6,654,503 B1) and Kajiwara (US 6028963 A).

Regarding Claim1: (Currently Amended) Merhav teaches a method for lossless coding of image and video media ("A complete characterization of optimal prefix codes for off-centered, two-sided geometric distributions of the integers is presented. These distributions are often encountered in lossless image compression applications, as probabilistic models for image prediction residuals." at abstract), comprising:

Sudharsanan expressly teaches splitting input image data into block portions (Refer to Figure 1A, numeral 61; column 2, line 64-66);

for an individual one of the block portions ("The pixels in each input block are coded using a differential pulse code modulation (DPCM) scheme that uses one of several selectable predictors." at column 2, line 3),

selecting one of multiple available differential pulse code modulation (DPCM) prediction modes to apply to the block portion that out of the available DPCM prediction modes yields a closer to optimal <u>two-sided, zero-biased </u>symbol distribution of a <u>run-length, Golomb-Rice entropy encoder</u> (Refer to Figure 1A, numeral 67-specifically from the "predictor index"; column 2, lines 1-50, specifically, column 2, line 4-6, further at column 3, line 2-11);

applying the selected DPCM prediction mode to the block portion; ~~and~~ entropy encoding DPCM residuals of the block portion <u>using run-length Golomb-Rice encoding; and</u> <u>outputting the encoded DPCM residuals of the block portion in a bitstream</u> ("Prediction residuals (difference between actual and predicted values) are mapped to a non-negative integer scale and are coded using a new entropy-coded mechanism based on a modified Golomb Code (MGC). In addition, a novel run-length encoding scheme is used to encode specific patterns of zero runs. The invention permits parallel processing of data blocks and allows flexibility in ordering the blocks to be processed." at column 2, line 8; "In a dynamic selection scheme, an optimal predictor for a given block can be found and used to obtain the prediction differences or residuals. The information needed to uniquely specify a predictor may be sent to the decoder as part of the coded bitstream." at column 3, line 44)<u>.</u>

Further, Kaijwara teaches selecting one of multiple available differential pulse code modulation (DPCM) prediction modes to apply to the block portion that out of the available DPCM prediction modes yields a closer to optimal <u>two-sided, zero-biased</u> symbol distribution of a <u>run-length, Golomb-Rice entropy encoder</u> (Refer to Figure 7 and 8, column 8, lines 56-column 10, lines 11). Specifically, wherein Figure 8 describes a "two-sided, zero-biased symbol distribution that is *close to optimal* with respect "The prediction value correction circuit 717 has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". at column 6, line 66. Also at Figure 7, numeral 714, is the run-length Golomb-Rice entropy encoder).

All of the claimed elements were known in the prior art at the time that the invention was made. A person of ordinary skill in the art could have combined the teachings of Merhav, Sudharsanan and Kaijwara by known methods with no change in their respective functions, and the combination of these teachings would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to select a differential pulse code modulation (DPCM) prediction mode to apply to the block portion that yields a closer to optimal two-sided, zero-biased symbol distribution of a run-length, Golomb-Rice entropy encoder.

The degree of "optimal yielding" is relative to the mode selection for the run-length Golomb Rice entropy encoder.

The motivation/suggestion for doing so would have been "The prediction value correction has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". (at column 6, line 66, Kaijwara.)" "...The encoding can be effectively performed by utilizing bias of the prediction error."

Therefore, at the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Merhav with Sudharsanan and Kaijwara to obtain the specified claimed elements of Claim 1.

Regarding Claim 9: (Original) Sudharsanan teaches the DPCM prediction modes comprise: a first mode in which a pixel's value is subtracted from its left neighboring pixel; a second mode in which a pixel's value is subtracted from its top neighboring pixel; a third mode in which a pixel's value is subtracted from a minimum or maximum of its left and top neighboring pixels; a fourth mode in which a pixel's value is subtracted from an average of its top and top right neighboring pixels; a fifth mode in which a pixel's value is subtracted from its top-left neighboring pixel; a sixth mode in which the difference between a pixel's top and top-left neighboring pixels is subtracted from its left neighboring pixel; and a seventh mode in which a pixel's value is subtracted from an average of the pixel's left and top neighboring pixels (Refer to Figure 1A, numeral 67 and adjacent, "Predictor Index").

Specifically, at the time that the invention was made, it would have been obvious to one of ordinary skill in the art that the "Predictor Index" as exemplified at Figure 1A embodies

a multitude of prediction modes from which to choose. By way of software implementation and manipulations, the user can provide/produce any variation of prediction modes to include at the "Predictor Index" such as those stated at Claim 9. Therefore it would have been obvious to one of ordinary skill in the art to substitute any of the first through seventh modes as suggested at Claim 9 in at the "Predictor Index" of Figure 1A because the substitution of one known element for another would have yielded predictable results for predicting a DPCM mode for lossless coding or the image data obtained.

Regarding Claim 10: (Currently Amended) Claim 10 equally resembles the specified claimed subject matter of Claim 1. Claim 10 embodies the computer-implemented media system that would be performing the method steps of the elements of Claim 1. Claim 10 stands rejected for the same reasons as stated above at Claim 1.

Regarding Claim 13: (Previously Presented) Sudharsanan teaches the DPCM prediction modes comprise: a first mode in which a pixel's value is subtracted from its left neighboring pixel; a second mode in which a pixel's value is subtracted from its top neighboring pixel; a third mode in which a pixel's value is subtracted from a minimum or maximum of its left and top neighboring pixels; a fourth mode in which a pixel's value is subtracted from an average of its top and top right neighboring pixels; a fifth mode in which a pixel's value is subtracted from its top-left neighboring pixel; a sixth mode in which the difference between a pixel's top and top-left neighboring pixels is subtracted from its left neighboring pixel; and a seventh mode in which a pixel's value is subtracted from an average of the pixel's left and top neighboring pixels (Refer to Figure 1A, numeral 67 and adjacent, “Predictor Index”).

Specifically, at the time that the invention was made, it would have been obvious to one of ordinary skill in the art that the "Predictor Index" as exemplified at Figure 1A embodies a multitude of prediction modes from which to choose. By way of software implementation and manipulations, the user can provide/produce any variation of prediction modes to include at the "Predictor Index" such as those stated at Claim 9. Therefore it would have been obvious to one of ordinary skill in the art to substitute any of the first through seventh modes as suggested at Claim 9 in at the "Predictor Index" of Figure 1A because the substitution of one known element for another would have yielded predictable results for predicting a DPCM mode for lossless coding or the image data obtained.

Regarding Claim 14: (Currently Amended) Claim 14 equally resembles the specified claimed subject matter of Claim 1 and Claim 10. Claim 14 embodies the computer-executable program instructions that would be performing the method steps of the elements of Claim 1 on the computer-implemented media system of Claim 10. Claim 14 stands rejected for the same reasons as stated above at Claim 1.

4. Claims 2,5,6,11,15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merhav (see citation above) in combination with Sudharsanan et al. (US 6,654,503 B1) and Kajiwara (US 6028963 A) and further in view of Irvine et al. US 2003/0039396 A1).

Regarding Claim 2: (Original) Merhav, Sudharsanan and Kaijiwara in combination teach all the claimed elements as rejected above. Merhav, Sudharsanan and Kaijiwara

in combination does not specifically teach or is silent about converting the input image data into an YCoCg color space format.

Irvine teaches converting the input image data into an YCoCg color space format ("A color signal may be converted from RGB space to YC1C2 space using a RGB to YC1C2 converter 116..." at paragraph [0052]).

Merhav, Sudharsanan and Kaijiwara and Irvine are combinable because they are in the same field of image compression and coding, specifically lossless compression.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to convert the input image data into an YCoCg color space format.

The motivation/suggestion for doing so would have been because "of the low spatial sensitivity of the eye to color. Many systems sub-sample the Co and Cg components by a factor of four in the horizontal and vertical directions. A full resolution image, known as 4:4:4 format, may be either very useful or necessary in some applications such as those referred to as covering "digital cinema." at [0052], Irvine.

This would make the overall color space and the format thereof, more efficiently suited to be manipulated (coded and decoded).

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Irvine with Merhav, Sudharsanan and Kaijiwara to obtain the specified claimed elements of Claim 2.

Regarding Claims 3-4: (Canceled)

Regarding Claim 5: (Original) Irvine teaches encoding the DPCM prediction mode and DPCM residuals with separate run-length, Golomb-Rice coding contexts (Refer to paragraph [0017]; Figure 1A, numeral 134, 138, 154).

Regarding Claim 6: (Currently Amended) Irvine teaches determining whether application of the selected DPCM prediction mode to the block portion produces all zero valued DPCM residuals (As is well known in the art, please refer to paragraph [0017]); also refer to paragraph [0074-0077]); and if so, encoding an ~~indication that the block portion is flat instead of~~ the <u>block portion </u>without entropy encoding DPCM residuals of the block portion (Specifically with reference to Figure 8, numeral 804,808 and 812, "The second, or next, DC component value of a given slice is then retrieved 816. The second DC component value is then compared with the first DC component value, and the difference, or residual, is encoded 820." at paragraph [0073].

Regarding Claim 11: (Previously Presented) Irvine teaches a color space conversion process for converting the input image data prior to a YCoCg color space format prior to coding ("A color signal may be converted from RGB space to YC1C2 space using a RGB to YC1C2 converter 116..." at paragraph [0052]).

Merhav, Sudharsanan and Kaijiwara and Irvine are combinable because they are in the same field of image compression and coding, specifically lossless compression.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to convert the input image data into a YCoCg color space format.

The motivation/suggestion for doing so would have been because "of the low spatial sensitivity of the eye to color. Many systems sub-sample the Co and Cg components by a factor of four in the horizontal and vertical directions. A full resolution image, known as 4:4:4 format, may be either very useful or necessary in some applications such as those referred to as covering "digital cinema." at [0052], Irvine.

This would make the overall color space and the format thereof, more efficiently suited to be manipulated (coded and decoded).

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Irvine with Merhav, Sudharsanan and Kaijiwara to obtain the specified claimed elements of Claim 11.

Regarding Claim 15: (Currently Amended) Irvine teaches determining whether application of the determined DPCM prediction mode to the macro- block produces flat residuals(As is well known in the art, please refer to paragraph [0017]); also refer to paragraph [0074-0077]); and if so, encoding the macro-block as ~~a flat macro block mode indication~~ without the RLGR entropy encoding the residuals of such flat macro-block (Specifically with reference to Figure 8, numeral 804,808 and 812, "The second, or next, DC component value of a given slice is then retrieved 816. The second DC component value is then compared with the first DC component value, and the difference, or residual, is encoded 820." at paragraph [0073].

Regarding Claim 16: (Original) Irvine teaches RLGR entropy encoding the macro-block mode indication using a separate RLGR coding context than for RLGR entropy encoding the residuals (Refer to paragraph [0017]; Figure 1A, numeral 134, 138, 154).

5. Claims 7, 8, 12 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merhav (see citation above) in combination with Sudharsanan et al. (US 6,654,503 B1) and Kajiwara (US 6028963 A) and further in view of Nakayama et al. (US 20030118242 A1)

Regarding Claim 7: (Original) Merhav, Sudharsanan and Kaijiwara in combination teach all the claimed elements as rejected above.

More specifically, Nakayama teaches the selecting the DPCM prediction mode comprises: determining whether the DPCM prediction mode yielding the closer to optimal symbol distribution for entropy coding is sufficiently close to the optimal symbol distribution for entropy coding (Refer to paragraph [0063]); and if not sufficiently close, applying no DPCM to the macro-block before the entropy encoding (Refer to Figure 4 and 5).

Further Kaijwara teaches selecting one of multiple available differential pulse code modulation (DPCM) prediction modes to apply to the block portion that out of the available DPCM prediction modes yields a closer to optimal two-sided, zero-biased symbol distribution of a run-length, Golomb-Rice entropy encoder (Refer to Figure 7 and 8, column 8, lines 56-column 10, lines 11). Specifically, wherein Figure 8 describes a "two-sided, zero-biased symbol distribution that is *close to optimal* with respect "The prediction value correction circuit 717 has therein a memory region for holding the

number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". at column 6,line 66. Also at Figure 7, numeral 714, is the run-length Golomb-Rice entropy encoder).

Merhav, Sudharsanan and Kaijiwara and Nakayama are combinable because they are in the same field of image compression and coding, specifically lossless compression.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to determine whether the DPCM prediction mode yielding the closer to optimal symbol distribution for entropy coding is sufficiently close to the optimal symbol distribution for entropy coding.

The motivation/suggestion for doing so would have been "The encoding can be effectively performed by utilizing bias of the prediction error." (column 12, line 33, Kajiwara)

Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Merhav, Sudharsanan, Kajiwara, and Nakayama to obtain the specified claimed elements of Claim 7.

Regarding Claim 8: (Original) Nakayama teaches the DPCM prediction modes comprise modes designed to produce an optimal distribution for entropy coding for block portions whose image content is predominantly a horizontal major edge, a vertical major edge, ramp diagonal edges, bands, and banded horizontal ramps (Refer to paragraph

[0057-0064]; specifically, "a two-dimensional transform can be performed by applying this transform in the horizontal direction and in the vertical direction, in the named order." at paragraph [0146]).

Regarding Claim 12: (Currently Amended) Nakayama teaches the DPCM prediction modes comprise modes designed to produce distributions close to the optimal <u>two-sided, zero-biased </u>RLGR entropy coding distribution for macro-blocks whose image content is predominantly a horizontal major edge, a vertical major edge, ramp diagonal edges, bands, and banded horizontal ramps (Refer to paragraph [0057-0064]; specifically, "a two-dimensional transform can be performed by applying this transform in the horizontal direction and in the vertical direction, in the named order." at paragraph [0146]).

Regarding Claim 17: (Currently Amended) Nakayama teaches determining whether the DPCM prediction mode producing a residual distribution closest to the optimal <u>two-sided, zero-biased </u>distribution produces a residual distribution sufficiently close to the optimal <u>two-sided, zero-biased </u>distribution (Refer to paragraph [0063]); and if not sufficiently close, RLGR entropy encoding the macro-block without applying the DPCM prediction mode to the macro-block (Refer to Figure 4 and 5).

Further Kaijwara teaches selecting one of multiple available differential pulse code modulation (DPCM) prediction modes to apply to the block portion that out of the available DPCM prediction modes yields a closer to optimal <u>two-sided, zero-biased</u> symbol distribution of a <u>run-length, Golomb-Rice entropy encoder</u> (Refer to Figure 7 and 8, column 8, lines 56-column 10, lines 11). Specifically, wherein Figure 8 describes a "two-sided, zero-biased symbol distribution that is *close to optimal* with respect "The

prediction value correction circuit 717 has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". at column 6,line 66. Also at Figure 7, numeral 714, is the run-length Golomb-Rice entropy encoder).

6. Claims 18-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakayama et al. (US 6560365 B1) in combination with Irvine et al. US 2003/0039396 A1), Sudharsanan et al. (US 6,654,503 B1) and Kajiwara (US 6028963 A).

Regarding Claim 18: (Currently Amended) Nakayama teaches a method of decoding predictive losslessly coded data of an image or video ("Accordingly, various efficient lossless compression and encoding methods have been proposed. For example, a lossless compression and encoding method has been proposed for outputting a difference between a pixel to be encoded and a predicted value generated by using peripheral pixels, and for performing Golomb-Rice coding for this difference. With this method, when decoding is performed, the original value of the object pixel is reconstructed by adding the value of each difference to a predicted value that is generated based on the decoded values for peripheral pixels." at column 1, line 18), comprising:

RLGR entropy decoding a macro-block mode (Refer to Figure 1, numeral 100),

a DPCM prediction mode and DPCM residuals for each of a plurality of macro-blocks using separate RLGR coding contexts; where the macro-block mode of a macro-block is

a flat macro-block mode, decoding the macro-block's pixels using a DPCM demodulation that is an inverse of the RLGR-decoded DPCM prediction mode of all zero residuals (Refer to Figure 1, numeral 104);

otherwise, where the DPCM prediction mode of the macro-block is a no DPCM prediction mode because application of possible DPCM prediction modes did not yield a symbol distribution for RLGR entropy encoding sufficiently close to an optimal symbol distribution for RLGR entropy encoding such that the symbol distribution meets a sufficiency threshold, decoding the macro-block's pixels without DPCM demodulation;

("The k parameter generating circuit 212 in FIG. 2 receives the parameters A and N corresponding to one status S, which is selected and output by the selector 211, and employs these parameters to generate the k parameter that is required for Golomb-Rice decoding." at column 6, line 47)

Irvine teaches otherwise, de-modulating the RLGR-decoded DPCM residuals using a DPCM demodulation that is an inverse of the RLGR-decoded DPCM prediction mode (Refer to the combination of numerals 1116, 1120 and 1136 at Figure 11); and assembling the macro-blocks to form a decoded image data ("Input B represents interframe residual lossy compressed encoded data, which is transferred to a Golomb-Rice decoder 1132. The Golomb-Rice decoder 1132 reverses the function of the Golomb-Rice encoder and transfers the output to an adder 1136. The adder 1136 adds the residual output with the output of the IDCT 1120 to produce lossless, interframe encoded data in the frequency domain. A color transformer 1140 coverts this back to the RGB form for final output. Different variations of color transforms may be utilized, such as those described in provisional patent application entitled "ABSDCT Lossless

Algorithm for Digital Cinema Archival Applications filed Jul. 11, 2002, Attorney Docket No. 010421P. Interframe decoding operates in a similar manner." at paragraph [0103]).

Sudharsanan teaches a DPCM prediction mode (Figure 1a, numeral 69) and DPCM residuals (Refer to Figure 1A, numeral 65)

Further, Kaijwara teaches multiple available differential pulse code modulation (DPCM) prediction modes to apply to macro-blocks using Run Length Golomb-Rice coding contexts (Refer to Figure 7 and 8, column 8, lines 56-column 10, lines 11). Specifically, wherein Figure 8 describes a "two-sided, zero-biased symbol distribution that is *close to optimal* with respect "The prediction value correction circuit 717 has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". at column 6,line 66. Also at Figure 7, numeral 714 is the run-length Golomb-Rice entropy encoder.

The "Prediction Device" as taught by Nakayama can be substituted with the DPCM prediction device as taught by Sudharsanan at (Figure 1a, numeral 69). All of these claimed elements were known in the prior art at the time that the invention was made. The claim would have been obvious by the substitution of the prediction device of Nakayama and the prediction mode selection of Sudharsanan because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

Nakayama, Irvine, Sudharsanan and Kajiwara (US 6028963 A) are combinable because they are in the same field of image compression and coding, specifically lossless compression.

All of the claimed elements were known in the prior art at the time that the invention was made. A person of ordinary skill in the art could have combined the teachings of Nakayama, Irvine, Sudharsanan and Kajiwara by known methods with no change in their respective functions, and the combination of these teachings would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to utilize a differential pulse code modulation (DPCM) prediction mode to apply to the block portion that yields or does not yield a closer to optimal two-sided, zero-biased symbol distribution of a run-length, Golomb-Rice entropy encoder.

The degree of "optimal yielding" and "sufficiency" is relative to the mode selection for the run-length Golomb Rice entropy encoder.

The motivation/suggestion for doing so would have been "The prediction value correction has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". (at column 6, line 66, Kaijwara.)" "...The encoding can be effectively performed by utilizing bias of the prediction error."

Further, it would have also been obvious to one of ordinary skill in the art to de-modulating the RLGR-decoded DPCM residuals using a DPCM demodulation that is an inverse of the RLGR-decoded DPCM prediction mode.

The motivation/suggestion for doing so would have been “Data output from the Golomb-Rice decoder 1144 is differential DCT data, representing the differences between elements between the current frame and the previous frame. A store 1148 stores data from the previous frame, and is added with to the DCT differentials by an adder 1152 resulting in lossy data in the DCT domain. Then, the lossy data in the DCT domain is transferred to an inverse quantizer 1156, whose output is transferred to the IDCT 1160. The IDCT 1120 decompressed by performing an inverse transform producing lossy decompressed frequency data.” at paragraph [0103, Irvine].

Therefore, at the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Nakayama, Irvine, Sudharsanan and Kajiwara to obtain the specified claimed elements of Claim 18.

Regarding Claim 19: (Original) Irvine teaches converting the decoded image data from a YCoCg color space format to a displayable color space format (“A color signal may be converted from RGB space to YC1C2 space using a RGB to YC1C2 converter 116...” at paragraph [0052]).

Regarding Claim 20: (Currently Amended) Irvine teaches a predictive-lossless coded image or video decoder (“Figure 11 illustrates a lossless decoder 1100, which operates

in an equal but opposite manner as described with the encoder of Figure 9." at paragraph [0101]; Figure 11 numeral 1112 and numeral 1144); comprising:

a run-length Golomb-Rice (RLGR) entropy decoder operating to decode RLGR-encoded DPCM residuals and DPCM prediction mode of a macro-block (Refer to Figure 11, numeral 1100);

a DPCM demodulator for applying an inverse of the DPCM prediction mode to the DPCM residuals <u>if the macro-block was encoded using a DPCM prediction mode</u> (Refer to Figure 11, numeral 1116)

<u>otherwise, where the macro-block was not encoded using a DPCM prediction mode because application of possible DPCM prediction modes did not yield a symbol distribution for RLGR entropy encoding sufficiently close to an optimal symbol distribution for RLGR entropy encoding such that the symbol distribution meets a sufficiency threshold, decoding the macro- block without DPCM demodulation;</u> (Refer to Figure 11, numeral 1100; "In an embodiment, the inverse serializer is an inverse Huffman serializer. The output of the serializer 1124 is transferred to an inverse quantizer 1128, whose output is transferred to the IDCT 1120. The IDCT 1120 decompressed by performing an inverse transform producing lossy decompressed frequency data." at paragraph [0101]) and

a macro-block reassembler for assembling the macro-block with other decoded macro-blocks to form data of a reconstructed image ("The final compressed output then corresponds to the one that uses the minimum number of bits per frame." at paragraph

[0097]; "The output of the variable length decoder 168 is provided to an inverse serializer 172 that orders the coefficients according to the scan scheme employed." at paragraph [106]).

otherwise, de-modulating the RLGR-decoded DPCM residuals using a DPCM demodulation that is an inverse of the RLGR-decoded DPCM prediction mode (Refer to the combination of numerals 1116, 1120 and 1136 at Figure 11); and assembling the macro-blocks to form a decoded image data ("Input B represents interframe residual lossy compressed encoded data, which is transferred to a Golomb-Rice decoder 1132. The Golomb-Rice decoder 1132 reverses the function of the Golomb-Rice encoder and transfers the output to an adder 1136. The adder 1136 adds the residual output with the output of the IDCT 1120 to produce lossless, interframe encoded data in the frequency domain. A color transformer 1140 coverts this back to the RGB form for final output. Different variations of color transforms may be utilized, such as those described in provisional patent application entitled "ABSDCT Lossless Algorithm for Digital Cinema Archival Applications filed Jul. 11, 2002, Attorney Docket No. 010421P. Interframe decoding operates in a similar manner." at paragraph [0103]).

Sudharsanan teaches a DPCM prediction mode (Figure 1a, numeral 69) and DPCM residuals (Refer to Figure 1A, numeral 65)

Further, Kaijwara teaches multiple available differential pulse code modulation (DPCM) prediction modes to apply to macro-blocks using Run Length Golomb-Rice coding contexts (Refer to Figure 7 and 8, column 8, lines 56-column 10, lines 11). Specifically, wherein Figure 8 describes a "two-sided, zero-biased symbol distribution that is *close to*

optimal with respect "The prediction value correction circuit 717 has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". at column 6,line 66. Also at Figure 7, numeral 714 is the run-length Golomb-Rice entropy encoder.

The "Prediction Device" as taught by Nakayama can be substituted with the DPCM prediction device as taught by Sudharsanan at (Figure 1a, numeral 69). All of these claimed elements were known in the prior art at the time that the invention was made. The claim would have been obvious by the substitution of the prediction device of Nakayama and the prediction mode selection of Sudharsanan because the substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

All of the claimed elements were known in the prior art at the time that the invention was made. A person of ordinary skill in the art could have combined the teachings of Irvine, Sudharsanan and Kajiwara by known methods with no change in their respective functions, and the combination of these teachings would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to utilize a differential pulse code modulation (DPCM) prediction mode to apply to the block portion that yields or does not yield a closer to optimal two-sided, zero-biased symbol distribution of a run-length, Golomb-Rice entropy encoder.

The degree of "optimal yielding" and "sufficiency" is relative to the mode selection for the run-length Golomb Rice entropy encoder.

The motivation/suggestion for doing so would have been "The prediction value correction has therein a memory region for holding the number N(S) of generation of the prediction error e for each context S and cumulative value E(S) of the prediction error e for each context S. In an initial state, all the values have been as "0". (at column 6, line 66, Kaijwara.)" "...The encoding can be effectively performed by utilizing bias of the prediction error."

Further, "Data output from the Golomb-Rice decoder 1144 is differential DCT data, representing the differences between elements between the current frame and the previous frame. A store 1148 stores data from the previous frame, and is added with to the DCT differentials by an adder 1152 resulting in lossy data in the DCT domain. Then, the lossy data in the DCT domain is transferred to an inverse quantizer 1156, whose output is transferred to the IDCT 1160. The IDCT 1120 decompressed by performing an inverse transform producing lossy decompressed frequency data." at paragraph [0103, Irvine].

Therefore, at the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine the teachings of Irvine, Sudharsanan and Kajiwara to obtain the specified claimed elements of Claim 20.

Regarding Claim 21: (Original) Irvine teaches an inverse YCoCg converter for converting the reconstructed image from a YCoCg color space to a color space suited for displaying the image (Refer to Figure 1, numeral 116).

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to substitute a YCoCg converter at Figure 11, numeral 1140 for converting the reconstructed image data suitable for display because a coder and decoder operate in an equal but opposite manner and the substitution of a color transformation at point relatable from an encoder to a decoder would yield the same predictable results to one of ordinary skill in the art. Additionally, "The pixel data may then have to be interpolated, converted to RGB form, and then stored for future display." at paragraph [0108]. This application can also be simply substituted for YCoCg data in place of RGB format (color space) and would have also yielded predictable results).

Response to Arguments

Information Disclosure Statement

7. The information disclosure statement (IDS) submitted on 07 July 2008 was considered in the prosecution of this instant application. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

8. Applicant's arguments, see page 9 of 18, with respect to Claim Objection (Claim 6) have been fully considered and are persuasive. The objection of Claim 6 has been withdrawn.

9. Applicant's arguments, see pages 9 and 10 of 18, with respect to 35 U.S.C. 101 Rejections have been fully considered and are persuasive. The 35 U.S.C. 101 rejection of claims 10-17 has been withdrawn.

10. Applicant's arguments see pages 10 of 18 with respect to the rejection(s) of claim(s) 1 under 35 U.S.C. 102 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Merhav et al. in combination with Sudharsanan et al. (US 6,654,503 B1) and Kajiwara (US 6028963 A).

11. Applicant's arguments, see pages 11 of 18, with respect to the rejection(s) of claim(s) 2-6,9, and 14-21 under 35 U.S.C. 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of prior art references made of record. See detailed rejections above.

12. Applicant's arguments see pages 12 of 18 with respect to the rejection(s) of claim(s) 10-13 under 35 U.S.C. 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of prior art references made of record. See detailed rejections above.

13. Applicant's arguments see pages 14 of 18 with respect to the rejection(s) of claim(s) 14-17 under 35 U.S.C. 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a

new ground(s) of rejection is made in view of prior art references made of record. See detailed rejections above.

14. Applicant's arguments see pages 15 of 18 with respect to the rejection(s) of claim(s) 18-21 under 35 U.S.C. 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of prior art references made of record. See detailed rejections above.

15. Applicant's arguments see pages 17 of 18 with respect to the rejection(s) of claim(s) 7 and 8 under 35 U.S.C. 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of prior art references made of record. See detailed rejections above.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is (571)270-1583. The examiner can normally be reached on Monday-Thursday 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mia M Thomas/

Examiner, Art Unit 2624

/Vikkram Bali/

Supervisory Patent Examiner, Art Unit 2624